121 - CENTER OF PRESSURE DISPLACEMENT PATTERN AND WEIGHT BEARING TRAINING THROUGH GAMES IN VIRTUAL REALITY

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INTRODUCTION

Exercise programs with an emphasis on dynamic movements and induction of unstable situations are usually performed by physiotherapists for training of postural control and as far as is known, appear to be the most effective way to train both static as dynamic stability in subjects with motor disabilities (Lord et al, 2003), however, no rehabilitation program of postural control was planned and executed exploring the development of specific motor skills that they focus on the mechanisms responsible for the dynamic stability after a disturbance, the that could contribute to the development of more effective interventions for preventing falls.

The Virtual Reality can be defined as a computing experience immersion, interactive and three dimensional occurring in real time and offers the individual the opportunity to join a multidimensional, multisensory virtual environment (Reid et al, 2004).

Currently being tested several electronic gaming consoles such as the Nintendo Wii®, in order to verify its applicability in physical rehabilitation programs. Therefore, systems Wii Sports® and Wii Fit® have been used in rehabilitation programs of postural control in subjects with motor impairments (Flynn et al., 2007; Deutsch et al., 2008). The system "Wii Balance board" comprises a peripheral resembling a force platform which carries individual into the game so that the movements of the body and the center of pressure (CP) are used to control the cursor, and thus achieve the desired goal of the task. Tasks are of therapeutic point of view, very appropriate, simple to be understood and motivating (Deutsch et al. 2008; Sugarman et al. 2009).

In Wii Fit® system, you can create advanced exercises involving mainly the control of static balance, in these games the individual has the possibility to display visual feedback as the movement of the center of pressure must remain within an area over the period of completion of the exercise, games like Bubble Balance (an avatar guide a path from the control of the displacement of the center of pressure), the tightrope Tension (walking a tightrope), twist the torso and waist (which uses the control trunk associated with the movement of the lower limbs to control the displacement of the center of pressure) and Table tilt (game balls fit in specific holes, which are controlled by the movement of the center of pressure of individuals) among many others, are examples exercises that Wii Fit® can provide during a training protocol aimed at improving postural control and quasi-static discharge control weight among members.

Additionally, the interface Wii Your Shape® is able to shoot and scan the body of the individual in order to design it within the physical activity program controlled by the game, so it is possible to train dynamic activities involving controlled movements of the upper and lower limbs.

Therefore the aim of this pilot study was to determine the pattern of displacement of the center of pressure (CP) of subjects who underwent a 10 minute workout in a gameterapia session and to present the alternative training weight discharges through games in virtual reality.

METHODOLOGY

1 Sample characterization:

The survey had a sample size of 16 healthy young participants, 9 men and 7 women. All signed, in duplicate, the term consent previously approved by the Research Ethics Committee of the State University of West Paraná (UNIOESTE) for notion 1046/2011. All data collection was performed at the Laboratory of Human Movement Analysis (LAPEMH) of the physiotherapy course UNIOESTE, located in the town of Cascavel-PR, Brazil.

1.1Inclusion criteria:

a) This study included subjects aged 18 years old

b) Until the time of the search said never had contact with the game of Table tilt gaming platform Wii Fit®.

1.2 Not inclusion criteria:

a) The not inclusion criterion were the presence of mental, physical or visual incompatible with the possibility of training with the virtual reality games.

b) Disagree with de terms condition.

2 Proceedings:

For the tests realization, the participants had to perform the tasks pertaining to the game of Table tilt platform Wii Fit®, this game should fit the individual spheres in specific holes, which are controlled by the movement of the center of pressure (CP). During the test, was positioning the peripheral and training tool (Wii Balance Board ®) on a force plate 45cm x 55cm (AMTI, USA) to collect data from ground reaction forces and moments of force that were converted to displacement of CP in the first 4 levels of difficulty of the game.

Two evaluations were performed, the first subjects were the 4 difficulty levels without any previous familiarization (called AV1), soon after, they had 10 minutes of training with the same game and then underwent a similar assessment to above (called AV2). During the evaluation of the data were collected displacements of CP in the first 4 levels of difficulty of the game.

3 Data analysis:

In this pilot study we conducted a descriptive analysis of parameters related to the mean displacement of CP in anteroposterior and mediolateral directions, to verify whether these data could actually be measured accurately in the laboratory. The data forces and moments of force were collected by the platform converted into offset values anteroposterior and mediolateral by the CP software AMTI Bioanalysis (AMTI, USA).

RESULTS

The descriptive results of the study showed that it was possible to measure the displacement of the participants through the medium displacement values of CP in anteroposterior and mediolateral direction in times AV1 and AV2. It is also possible to identify that the means of displacement of CP were changed according to the level of difficulty of the game (Tables 1 and 2).

Table 1

Displacements Average A-P	*AV1*	*AV2*
LEVEL1	-1.61653	-0.62527
LEVEL 2	3.06069	4.35713
LEVEL 3	2.20573	0.13907
LEVEL 4	1.34980	2.21960

Table 1: Mean Displacement CP anteroposterior in the assessments. Positive and negative values are related to the prevalence of anterior and posterior, respectively.

Table 2

Displacements Average M-L	*AV1*	*AV2*
LEVEL 1	-0.99473	-0.38587
LEVEL 2	0.01200	-1.27844
LEVEL 3	-0.04747	0.24570
LEVEL 4	-0.10500	0.48840

Table 2: Displacement average CP mediolateral in the assessments. Positive and negative values are related to the prevalence of anterior and posterior, respectively.

DISCUSSION

With the technological world evolution, more and more software is being developed that interact with humans, with this obviously comes with the intention to rehabilitate individuals with motor deficits by making use of virtual reality, however, there is a need to verify the effectiveness and provide a scientific character to this promising therapy.

Deutsch et al., 2008, did a case study using the Nintendo Wii® as a tool for physical rehabilitation, however, used as parameters to gauge the improvement of the individual scores, provided by the game, in this study we quantify the value of displacement CP participants. The study was able to measure the data of ground reaction forces of the subjects depending on the activity (task) exerted in the game, this same method can also be applied during the rehabilitation of patients, possibly checking the correlation of these variables with the potential to progress of patients who are undergoing therapy through games in virtual reality.

Besides the data cited in the study (median anteroposterior and mediolateral displacement of CP) the force platform provides the possibility of analyzing many other kinematic variables that can help identify treatment efficacy, as the correlation coefficient and the area of 95% ellipse. Demonstrating the ability of the evaluation of the force platform Ralmieri et al, 2002, proposed that first it is necessary to determine the clinically deficit of postural control after the deficit has been proven to perform measurements on a force platform and see which treatment will be most effective to restore postural control more appropriate, taking into account that training a correct weight-bearing lower limb is a crucial part of physiotherapy treatment in order to avoid this, any tool that has proven to work with this in mind is important in the rehabilitation process.

With the completion of assessments and training in an instrument that is suitable of being placed on the force plate, configures the possibility to measure the variables of displacement throughout the rehabilitation process and not just at different times.

In resume, it is necessary to further studies checking the results caused by virtual reality therapy in different conditions, except that the peripheral Wii Balance board to be an effective tool in the assessment of CP. The proof of the success of this type of rehabilitation will contribute to improved prognosis for rehabilitation of patients and especially the eventual improvement in stability may produce beneficial effect, reducing the occurrence of falls. Moreover, it is a new type of therapy being provided which can be applied with greater reliability.

CONCLUSION

This study shows that weight bearing training between limbs through games in virtual reality is a suitable alternative, and it provides the possibility to measure the pattern of weight displacement of the CP during the course of the activity. The data from the force platform related to displacement anteroposterior and mediolateral can be correlated with variables that identify the potential for development, enabling the monitoring of the performance of patients who undergo this type of intervention.

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ABSTRACT

Currently the electronic gaming consoles have been used in physical rehabilitation programs. With the Nintendo Wii Fit® system can develop a training protocol aimed at improving postural control and control of weightbearing between members. The objective of this pilot study was to determine the pattern of displacement of the center of pressure (CP) of subjects who underwent a 10 minute workout in a gameterapia to present the alternative training weight discharges through games in virtual reality. For both 16 volunteers underwent two evaluations, one before any familiarity with the game Tilt Table® games belonging to Nintendo Wii® console and another after 10 minutes of training. During the evaluations, the training tool (Wii Balance Board®) was placed on the force platform to collect data concerning the pattern of displacement of the center of pressure in the first 4 levels of difficulty of the game. The data described were the anterior-posterior and medial-lateral. As a result shows that the subjects have explored its support base by means of displacement of CP during the execution of the task, moreover, by means of offset values of the pressure center can perform a quantitative analysis of the training participants, which indicates that it is feasible to train discharges weight using the Wii Fit® system in the laboratory, thus tracking the performance of patients who undergo this type of intervention.

KEYWORDS: rehabilitation, physiotherapy, virtual reality.

CENTRE DE VOYAGE NORME DE PRESSION ET DECHARGE DE MUSCULATION PAR LE JEU EN RÉALITÉ VIRTUELLE

RÉSUMÉ

Actuellement, les consoles de jeux électroniques ont été utilisés dans des programmes de réadaptation physique. Avec la Nintendo Wii Fit® système peut développer un protocole de formation visant à améliorer le contrôle postural et le contrôle des weightbearing entre les membres. L'objectif de cette étude pilote était de déterminer l'évolution des déplacements du centre de pression (CP) des sujets ayant subi une séance d'entraînement de 10 minutes dans un match et encore gameterapia présents décharges alternatives de formation de poids grâce à des jeux en réalité virtuelle . Pour les deux 16 volontaires ont subi deux évaluations, l'une avant toute familiarité avec la table de jeu Tilt ® jeux Wii Fit® appartenant à la console Nintendo Wii ® et un autre au bout de 10 minutes d'entraînement. Lors des évaluations, l'outil de formation (Wii Balance Board®) a été placé sur la plate-forme de force de collecter des données relatives à l'évolution des déplacements du centre de pression dans les 4 premiers niveaux de difficulté de la partie. Les données ont été décrits l'axe antéro-postérieur et latéral-médial. Comme un résultat montre que les sujets ont exploré sa base de support par des moyens de déplacement de CP pendant l'exécution de la tâche, en outre, au moyen de valeurs de décalage du centre de pression peut effectuer une analyse quantitative des participants à la formation, ce qui indique qu'il est possible de former poids décharges en utilisant le Wii Fit® dans le laboratoire, ainsi le suivi de la performance des patients qui subissent ce type d'intervention.

MOTS-CLÉS: réadaptation, la physiothérapie, la réalité virtuelle.

CENTRO DE PRESSIÓN ESTANDAR DE CARGA Y DESCARGA DE FORMACIÓN DE PESO A TRAVÉS DEL JUEGO EN REALIDAD VIRTUAL

RESUMEN

Actualmente las consolas de juegos electrónicos se han usado en programas de rehabilitación física. Con la Nintendo Wii Fit System® se puede desarrollar un protocolo de entrenamiento dirigido a mejorar el control postural y el control de soporte de peso entre los miembros. El objetivo de este estudio piloto fue determinar el patrón de desplazamiento del centro de presiones (CP) de los pacientes que se sometieron a un entrenamiento de 10 minutos en un partido y todavía gameterapia actuales vertidos de formación alternativa de peso a través de juegos de realidad virtual . Tanto para 16 voluntarios se sometieron a dos evaluaciones, una antes de cualquier familiaridad con el juego de mesa basculante® juegos de Wii Fit® pertenecientes a la consola Nintendo Wii® y otro después de 10 minutos de entrenamiento. Durante las evaluaciones, la herramienta de formación (Wii Balance Board®) fue colocado en la plataforma de fuerza para recoger datos sobre el patrón de desplazamiento del centro de presión en los primeros 4 niveles de dificultad del juego. Los datos descritos eran la anterior-posterior y medial-lateral. Como resultado muestra que los sujetos han explorado su base de apoyo por medio de desplazamiento de CP durante la ejecución de la tarea, por otra parte, por medio de valores de compensación del centro de presión se puede realizar un análisis cuantitativo de los participantes en la formación, lo que indica que es factible para entrenar peso vertidos usando el Wii Fit® sistema en el laboratorio, así rastrear el rendimiento de los pacientes que se someten a este tipo de intervención.

PALABRAS CLAVE: rehabilitación, terapia física, la realidad virtual.

PADRÃO DE DESLOCAMENTO DO CENTRO DE PRESSÃO E TREINAMENTO DE DESCARGA DE PESO POR MEIO DE JOGO EM REALIDADE VIRTUAL

RESUMO

Atualmente os consoles de jogos eletrônicos vêm sendo utilizados em programas de reabilitação física. Com o sistema Nintendo Wii Fit® é possível elaborar um protocolo de treinamento visando à melhora do controle postural e do controle da descarga de peso entre membros. Assim, o objetivo deste estudo piloto foi verificar o padrão de deslocamento do centro de pressão (CP) de indivíduos submetidos a 10 minutos de treino em um jogo de gameterapia e ainda apresentar a alternativa de treinar descargas de peso por meio de jogos em realidade virtual. Para tanto 16 voluntários foram submetidos a duas avaliações, uma antes de qualquer familiarização com o jogo Table tilt® do pacote de jogos Wii Fit® que pertence ao console Nintendo Wii® e outra após 10 minutos de treinamento. Durante as avaliações, o instrumento de treinamento (Wii Balance Board®) foi posicionado sobre a plataforma de força para coletar os dados referentes ao padrão de deslocamento do centro de pressão nos 4 primeiros níveis de dificuldade do jogo. Os dados descritos foram os deslocamentos ântero-posterior e médio-lateral. Como resultado observa-se que os sujeitos exploraram sua base de suporte por meio do deslocamento do CP durante a execução da tarefa, além disso, por meio dos valores de deslocamento do centro de pressão é possível realizar uma análise quantitativa do treinamento dos participantes, o que permite concluir que é viável treinar descargas de peso utilizando o sistema Wii Fit® em laboratório, possibilitando o acompanhamento da performance de pacientes que são submetidos a esse tipo de intervenção.

PALAVRAS-CHAVE: reabilitação, fisioterapia, realidade virtual.