21 - CEREBRAL ESTIMULATION AND MOTOR LEARNING: EFFECTS IN BOWLING'S GAME LEARNING

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Introduction

Learning and memory are indissoluble processes correlates and. Learning corresponds to the acquisition of new knowledge and consequence modification of the behavior, while the memory can be understood as the retention of this knowledge (MAXWELL et al., 2003). This way, these two processes share similar neural mechanisms, being these responsible ones also for the attention, sensorial integration and perception (JUEPTNER, 1997). It does not date today of the interest of researchers for alterations produced in the nervous system in function of the motor learning, also known as memory of procedures. This type of memory is resultant of the increase of the performance and proportionally of the increment of the precision of motor gesture (GUISE et al., 1999). On the basis of the same definition, the wolf frontal (both the hemispheres) is pointed as important structure with respect to the learning of unilateral procedures. The previous portion of the calosum's body, for connecting these two hemispheres, becomes crucial for the integration and transference of the procedure abilities in a complementary form. This structural complex provides base for the learning of bimanual tasks. The learning gradually produces reduction in the error inlaid in the task, increase of the coordination and greater agility and speed in the execution of movement (KARNI et al., 1995). This implement of the performance, observed in the learning process, has been associated the complex mechanisms of consolidation of memory of long stated period.

In function of the diversity of components that are reorganized plastic, the agreement of the effect of the motor learning in the cortex became a challenge in the field of the neuroscience. Neural plastic rooms of the nervous system have guided the understanding of experimental models on the filling of motor information. The combination between sensorial memory (sensorial stimulations), memory of short term (work memory) and memory of long duration represented in the nervous system through the consolidation and the execution of the motor gesture would lead to a new order in neural configuration (COHEN et al., 1993; DONOGUE et al., 1995).

The cerebral stimulation is a technology that promotes changes of cerebral standards for conditioning and/or conscientious interaction, being able to be provided by the systems, auditory appearance and/or, besides also being able to be extrinsic or intrinsic, through the use of electronic devices that emit light and/or sound, being able to promote the facilitation of motor learning (HUTCHISON, 1986; SIEVER, 1999).

Objective

Inside of this context, the objective of this study was to investigate the influence of a cerebral stimulation with auditory stimulations' program, at the increase of the performance of Bowling's game visualized at the increase of the average of rightness in the evaluations of Bowling's game.

Methods

Subjects

Had been selected 20 children, in the ages of 7 the 8 years, both the sorts, students of the first cycle of basic education, in a particular school of Jacarepaguá's quarter, in the city of Rio de Janeiro, being divided randomly in a Control Group (CG) and an Experimental Group (EG). The citizens had only been enclosed in the present study that had been considered of low ability in the game through a diagnostic evaluation. All the responsible ones for the children had signed the assent terms, taking care of the Norms for the Accomplishment of Research in Human beings, Resolution 196/96, of the National Advice of Health of 10/10/1996.

Experimental design

After the random division of the groups, was selected a group to carry through the program of Bowling's training, parallel with the program of a cerebral stimulation with auditory stimulations' training, called Experimental Group (GE), and to another part of the sample it formed the group that only participated of the program of Bowling's training, the Control Group (CG). Both the programs had been carried through in 36 sessions, being the Bowling's program having the duration of 45 minutes, and the program of cerebral stimulation with auditory stimulations' training, having its sessions with 35 minutes of duration carried through before the Bowling's program. For being a new sport for the sample of the present work, it was decided that a time for the adaptation of this would be had stops with the material used for the practical one of Bowling, that was of 1 hour. After that the first collection of data in the form of 1 complete departure of Bowling was carried through where all had had its average of rightness verified. After the ending of the 36 sessions of training, was carried through a new collection through a new departure being verified a new average.

Instruments

For the training of cerebral stimulation with auditory stimulations an electronic device called Binaural Beats manufactured for the Atilla Ltda. was used, composition for a stereo earphone and a microprocessor where if they find the sessions preprogrammed, of which the appropriate session for learning was used (SIEVER, 1999). For the Bowling's training a track of Bowling was used, with official measures, however, having been constructed artisan, beyond a set of official bolts and balls you officiate with weight and measure in accordance with the age band of our sample, respecting the norms and official rules imposed by a FIQ (International Federacy Quilleurs).

Statistical treatment

The analysis of the data of this study was carried through on the basis of the comparison of statistical results using the program of statistics SPSS 10.0. Through the results gotten for the averages of rightness of the evaluations of Bowling, they had been calculated through the descriptive statistics, the average and the shunting line standard. Already for the verification of the variance was used the test of normality of Shapiro-Wilk for a $n<50$ and a test of accompaniment of Tukey (HSD), for a level of significance of $p=0.05$.

Results and discussions

These data mention the profits to it gotten for the effect of cerebral stimulation's training, taking itself in consideration, for analysis, the increase of the motor performance of the reflected Experimental Group in the increase of its average of rightness. The table 1 presents the results of the averages of rightness of the Control Group (CG) and of the Experimental Group (EG) related the evaluations of Bowling.

Table 1: Average and shunting line standard of the evaluations of the Control Group (CG) and of the Experimental Group (EG).

Groups	Pre Control	Post Control	Pre Experimental	Post Experimental
Mean	35,9	46,9	37,9	76,6
Std. Deviation	5,93	6,82	5,43	4,79

When analyzing separately the data of the averages of rightness obtained for the Control Group and the Experimental Group, before and after the training program, verified a significant difference between the groups, being that the experimental group was superior. The test of normality of small Shapiro-Wilk was carried through due to the quantitative one of in agreement sample shows table 2, and the Test of accompaniment of Tukey HSD for the confirmation of the in agreement result shows table 3, presenting one p=0.05.

Table 2: Tests of Normality

Shapiro-Wilk		
Statistic	Df	Sig.
,963	10	,823
,920	10	,360
,929	10	,435
,958	10	,760

Table 3: Test of accompaniment of Tukey HSD

(I) groups	(J) groups	Mean Difference (I-J)	Std. Error	P	95% Confidence Interval	
					Lower Bound	Upper Bound
Pre Control	Post Control*	-11	2,59	**0,00**	-18,0	-4,0
	Pre Experimental	-2	2,59	0,87	-9,0	5,0
	Post Experimental*	-40,7	2,59	**0,00**	-47,7	-33,7
Post Control	Pre Control*	11	2,59	**0,00**	4,0	18,0
	Pre Experimental*	9	2,59	**0,01**	2,0	16,0
	Post Experimental*	-29,7	2,59	**0,00**	-36,7	-22,7
Pre Experimental	Pre Control	2	2,59	0,87	-5,0	9,0
	Post Control*	-9	2,59	**0,01**	-16,0	-2,0
	Post Experimental*	-38,7	2,59	**0,00**	-45,7	-31,7
Post Experimental	Pre Control*	40,7	2,59	**0,00**	33,7	47,7
	Post Controle*	29,7	2,59	**0,00**	22,7	36,7
	Pre Experimental*	38,7	2,59	**0,00**	31,7	45,7

*** p = 0.05**

Leaving of the estimated theoreticians of whom the brain has capacity to process information, to one alone time, with the two hemispheres; Siever (1999) clarifies that brain is structure highly plastic, of that is possible, by means of stimulation external auditory, promoting balancing cerebral, that is the name given to the process of balance of the brain in its diverse areas in the performance of its varied functions, in that it refers to the electric activity generated by the neurons of proportional, coherent and adjusted form, expressing harmony and psicophysic balance (SIEVER, 1999), to obtain the otimization of the learning and memorization. The "binaural beats" or binaural strokes, emits 2 coherent sounds of almost similar frequencies presented with phones stereos in each ear. Originating in the superior nucleus to olivar, I besiege it of the contralateral integration of auditory entrance (OSTER, 1973), being the frequency of binaural strokes neurologic carried to the reticular formation, being this the structure that regulates and controls the level of stress, attention and conscience (HUTCHISON, 1986) preponderant factors for a good learning and memorization (SCHMIDT, 2000), through information (internal and external sensorial stimulations) in which the thalamus and the cortex are directed of the reticular formation for. Research has suggested that the use of the application of binaural strokes can contribute for the establishment of variation in the individual psicophysiology homeostatic standard's (cortical standards), in which can precipitate alterations in cognitive processes (PICTON et al., 1978ab).

Conclusion

The present inquiry if considered to observe changes in the acquisition of motor abilities of the Bowling's game in children trained with cerebral stimulation for auditory stimulations. Specifically, neural modifications had been observed that occur during the acquisition of a motor sensory ability involving sensorial memory (acquisition of motor abilities of the Bowling's game) and memory of short term. The average of rightness also increased to the measure that the citizens had been more skillful in the task of Bowling. Essentially, this standard of results was evidenced between the evaluations daily pay and after cerebral stimulation's training. Being thus, the results gifts had reproduced found previous, in which were perceived increase of the performance when individuals had been displayed to a task (cerebral stimulation) sensory motor (KARNI et al., 1995; SMITH et al., 1999). The improvements in the performance in accordance with are found previous of some motor research sensory, which citizens had that to manage information of the procedural memory (CARLSON et al., 1992). Moreover, based in the results gifts, clearly a "critical period" during the learning process was characterized, in the transition between the evaluations. These findings suggest that this "critical moment" is associated with the transition enters the mechanisms of control and the automation of the movement. Mechanisms of control are associates to the initial phase of the learning, when the individuals need to place an extreme dose of attention when playing the motor gesture. Therefore, he is thus demonstrated that the training of cerebral stimulation for auditory stimulations can, in certain way, to influence in the condition of motor learning.

References

CARLSON, R.; LUNDY, D.; SCHEIDER, W. Strategy guidance and memory aiding in learning a problem-solving skill. **Hum Factors, vol. 34, p. 129-45, 1992.**

COHEN, L.; BRASIL, N.; PASCUAL-LEONE, L.; HALLET, M. Plasticity of cortical motor output organization following deafferentation, cerebral lesions, and skill acquisition. **Adv. Neurol., vol. 63, p. 187-200, 1993.**

DONOGHUE, J. Plasticity of sensorimotor representations. **Curr. Opin. Neurobiol., vol. 5, p. 749-754, 1995.**

GUISE, E.; DEL PESCE, M.; FOSCHI, N.; QUATTRINI, A.; PAPO, I.; LASSONDE, M. Collosal and cortical contribution to procedural learning. **Brain, vol. 122, p. 1049-1062, 1999.**

HUTCHISON, M. **Megabrain: New tools and techniques for brain growth and mind expansion.** New York: Beech Tree Books, 1986.

Izquerdo I. Memória. São Paulo: Artmed, 2002

JUEPTNER, M.; STEPHAN, K.; FRITH, C.; BROOKS, D.; FRACKOWIAK, R.; PASSINGHAM, R. Anatomy of motor learning: I. Frontal cortex and attention to action. **J. Neurophysiol., vol. 77, p. 1313-1324, 1997.**

KARNI, A.; GUNDELA, M.; JEZZARD, P.; ADAMS, M.; TURNER, R.; UNGERLDER, L. Functional MRI evidence for adult motor cortex plasticity during motor skill learning. **Science, vol. 377, p. 155-158, 1995.**
MAXWELL, J.; MASTERS, R.; EVES, F. The role of working memory in motor learning and performance. **Conscious Cogn., vol. 12, p. 376-402, 2003.**
OSTER, G. Auditory beats in the brain. **Scientific American, vol. 229, p. 94-102, 1973.**
PICTON, T. W.; WOODS, D. L.; PROULX, G. G. Human auditory sustained potentials. I. The nature of the response. **Electroencephalography and Clinical Neurophysiology, vol. 45, p. 186-197, 1978a.**
PICTON, T. W.; WOODS, D. L.; PROULX, G. G. Human auditory sustained potentials. II. Stimulus relations. **Electroencephalography and Clinical Neurophysiology, vol. 45, p. 198-210, 1978b.**
SCHMIDT, Richard A., WRISBERG, A. **Aprendizagem motora**: uma abordagem da aprendizagem baseada no problema. 2ª.edição. Porto Alegre: Editora Artmed, 2001.
SIEVER, D. **The Rediscovery of Áudio-visual Entrainment Technology.** 5ª ed., Canadá, Comptronic Devices Limited, 1999.
SMITH, M.; MCEVOY, L.; GEVINS, A. Neurophysiological indices of strategy development and skill acquisition. **Cogn. Brain Res., vol. 7, p. 389-404, 1999.**
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CEREBRAL ESTIMULATION AND MOTOR LEARNING: EFFECTS IN BOWLING'S GAME LEARNING

The objective of the present study was to investigate the influence of a cerebral stimulation with auditory stimulations' training program, in the motor learning and memorization, the learning of the bowling's game. Had been selected 20 children with age band of 7 and 8 years old, in which Experimental Group (GE) and Control Group had been divided in (GC), having carried through GE a program of 36 sessions of Bowling's training with duration of 45 minutes parallel to the cerebral stimulation with auditory stimulations' training program with duration of 35 minutes. Already the GC only carried through the program of Bowling's training with the same number of sessions and same duration. The data daily pay and after-program had disclosed that the Experimental Group in which used the program of a cerebral stimulation for auditory stimulations' training, were significantly superior to the Group Control (p=0.05) in relation the performance in learning and memorization. One concludes that the here described results are substantial in that the interactivity says respect enters a program of a cerebral stimulation with auditory stimulations' training and motor learning and memorization.
Key - words: Motor learning, bowling, cerebral stimulation

ESTIMULATION CÉRÉBRAL ET APPRENTISSAGE MOTEUR: DES EFFETS EN JEU DU ROULEMENT APPRENANT

Le but de la présente étude ont été étudiés l'influence d'un programme de formation cérébral d'estimulation avec des stimulis auditivy dans l'apprentissage moteur et la mémorisation, dans l'étude du jeu du bowling. Étaient selecionated ramdonmily 20 childs avec l'âge entre 7 et 8 ans de qui ont été partagés dans le groupe expérimental et le groupe de commande (CG.), le groupe expérimental a eu un programme de 36 sessions de la formation du bowling avec la durée 45 minute en même temps au programme de formation cérébral d'estimulation avec des stimulis auditivy avec la durée 35 minute. Pourtant le groupe de commande a eu seulement le programme du bowling avec le mêmes nombre et durée de sessions. Le programme des dates de ligne de base et de poteau reveled que le groupe expérimental qui utilizated le programme de formation cérébral d'estimulation avec des stimulis auditivy, était supérieur de manière significative au groupe de commande (p=0.05) relié dans l'exécution dans l'étude et la mémorisation. Acording aux résultats ici a décrit ceux sont des parties essentielles dans la relation l'interactivité entre un programme de formation cérébral d'estimulation avec des stimulis auditivy et l'apprentissage moteur et la mémorisation.
Clef - mots: Apprentissage moteur, roulant, stimulation cérébrale

ESTIMULACIÓN CEREBRAL Y APRENDIZAJE MOTRIZ: EFECTOS EN EL APRENDIZAJE DEL JUEGO DE BOLICHE

El objetivo del estudio ha sido investigar la influencia de un programa de entrenamiento de estimulación cerebral con estímulos auditivos, en el aprendizaje motriz y memorización, en el aprendizaje del juego boliche. Han sido seleccionados aleatoriamente 20 niños con edad entre 7 y 8 años, en la cual han sido divididos en Grupo Experimental (GE) y en Grupo Control (GC), habiendo realizado el GE un programa con 36 sesiones de entrenamiento de Boliche con duración de 45 minutos paralelamente al programa de entrenamiento con estimulación cerebral con estímulos auditivos con duración de 35 minutos. El GC realizó solamente el programa de Boliche con la misma cantidad y duración de las sesiones. Los datos pre y post entrenamiento revelarón que el Grupo Experimental en la cual utilizó el programa de entrenamiento con estimulación cerebral con estímulos auditivos, ha sido significativamente superior al Grupo Control (p=0.05) en respeto a la performance en aprendizaje y memorización. Se concluye que los resultados aquí referidos son sustanciales en que se refiere a la interactividad entre un programa de entrenamiento con estimulación cerebral con estímulos auditivos y aprendizaje motriz y memorización.
Palabras - clave: aprendizaje motriz, boliche, estimulación cerebral

ESTIMULAÇÃO CEREBRAL E APRENDIZAGEM MOTORA: EFEITOS NO APRENDIZADO DO JOGO DE BOLICHE

O objetivo do presente estudo foi investigar a influência de um programa de treinamento de estimulação cerebral com estímulos auditivos, na aprendizagem motora e memorização, na aprendizagem do jogo de boliche. Foram selecionadas aleatoriamente 20 crianças com faixa etária de 7 a 8 anos, na qual foram divididas em Grupo Experimental (GE) e Grupo de Controle (GC), tendo o GE realizado um programa de 36 sessões de treinamento Boliche com duração de 45 minutos paralelamente ao programa de treinamento de estimulação cerebral com estímulos auditivos com duração de 35 minutos. Já o GC realizou somente o programa de Boliche com o mesmo número de sessões e mesma duração. Os dados pré e pós-programa revelaram que o Grupo Experimental na qual utilizou o programa de treinamento de estimulação cerebral por estímulos auditivos, foi significativamente superior ao Grupo Controle (p=0.05) em relação a performance em aprendizagem e memorização. Conclui-se que os resultados aqui descritos são substanciais no que diz respeito a interatividade entre um programa de treinamento de estimulação cerebral por estímulos auditivos e aprendizagem motora e memorização.
Palavras chave: aprendizagem motora, boliche, estimulação cerebral.