STUDIA UBB EDUCATIO ARTIS GYMN., LIX, 1, 2014, pp. 17 - 21
(RECOMMENDED CITATION)

VISUAL CONTROL OF POSTURAL BALANCE OF FIELD TENNIS PLAYERS

COSMIN MIHAI MOCA[1,*]

ABSTRACT. *Background*. Cognitive control processes include a broad class of mental operations including goal or context representation and maintenance, and strategic processes such as attention allocation and stimulus-response mapping. Cognitive control is associated with a wide range of processes and is not restricted to a particular cognitive domain. *Aims*. The aims for this research are the following: 1. The determination of area and length for the trajectory of the weight center's projection using AMTI Netforce platform, 2. Identifying the influence of the visual stimuli over the postural balance; *Methods.* The methods used: 1. The AMTI Netforce platform (Hardware and Software), 2.Using the postural balance measurement from AMTI Netforce for: a) eyes opened no aiming point, b) eyes opened with aiming point. *Results.* After the statistical analysis we have the following: a) for the initial test: M_{LI}=152218.44, SD_{LI}=113973.166 (for the trajectory length of center of gravity) and M_{AI}=15328.81, SD_{AI}=3465.370 (for the trajectory area of center of gravity); b) for the final test: M_{LF}=5960.86, SD_{LF}=5283.156 and M_{AF}=2613.83, SD_{AF}=1564.17. *Conclusions*. These results suggest that the visual control really does have an effect over the balance control of the tennis players. Specifically, our results suggest that when the subject has a visual way to control his posture, the balance control increases.

Key words: balance, visual control, sport, psychology, cognitive control

REZUMAT. ***Controlul vizual al echilibrului postural la sportivii care practică tenis de câmp.*** *Premize*. Procesele controlului cognitiv includ o amplă clasă de operaţii mentale care includ reprezentanţa şi menţinerea obiectivelor şi a contextului. Totodată controlul cognitiv include şi procesele strategice precum alocarea atenţiei şi formarea hărţii stimul-răspuns. Controlul cognitiv este asociat cu o largă paletă de procese care nu este restrânsă la un domeniu cognitiv particular. *Obiective*. Obiectivele acestui studiu au fost: 1. Determinarea ariei si a lungimii traiectoriei proiecţiei centrului de greutate utilizând platforma AMTI Netforce, 2. Identificarea influenţei stimului vizual în controlul echilibrului postural. *Metode*. Metodele folosite: 1. Platforma de forţă AMTI Netforce (Hardware

[1] *Babeş-Bolyai University, Physical Education and Sports Faculty, Cluj-Napoca, Romania*
* *Corresponding author: cosminmoca@yahoo.com*

și Software), 2. Utilizarea platformei AMTI Netforce pentru a măsura echilibrul postural: a)cu ochii deschişi fără reper, b) cu ochii deschişi cu reper. *Rezultate*. După prelucrarea statistică a datelor avem următoarele: a) pentru testul inițial: M_{LI}=152218.44, SD_{LI}=113973.166 (pentru lungimea traiectoriei centrului de greutate) and M_{AI}=15328.81, SD_{AI}=3465.370 (pentru aria traiectoriei centrului de greutate); b) pentru testul final: M_{LF}=5960.86, SD_{LF}=5283.156 and M_{AF}=2613.83, SD_{AF}=1564.17. *Concluzii*. Aceste rezultate sugerează existența unui control vizual ridicat al echilibrului postural la sportivii care practică tenis de câmp. În special rezultatele noastre sugerează că atunci când sportivul are posibilitatea de a-și controla postura, controlul echilibrului crește.

Cuvinte cheie: echilibru, control vizual, sport, psihologie, control cognitiv

Background

"Cognitive control" is a construct from contemporary cognitive neuroscience that refers to processes that allow information processing and behavior to vary adaptively from moment to moment depending on current goals, rather than remaining rigid and inflexible. Cognitive control processes include a broad class of mental operations including goal or context representation and maintenance, and strategic processes such as attention allocation and stimulus-response mapping. Cognitive control is associated with a wide range of processes and is not restricted to a particular cognitive domain. For example, the presence of impairments in cognitive control functions may be associated with specific deficits in attention, memory, language comprehension and emotional processing. Given its pervasive influence, impaired cognitive control could account for many of the widespread impairments exhibited by people with schizophrenia and other neurodevelopmental disorders. (Carter & Cho 2004)

It is the set of brain processes necessary for goal-directed thought and action. Remembering a phone number before dialing requires cognitive control. Also, anything outside routine requires cognitive control (because it's novel and/or conflicting with what you normally do). This includes, among other things, voluntarily shifting attention and making decisions. (Cole & Schneider, 2007)

A mountain of evidence is accumulating that a common set of brain regions are involved in cognitive control. We looked for these regions specifically, and verified that they were active during our experiment. The brain regions are spread across the cortex, from the front to the back to either side. However, it's not the whole brain: there are distinct parts that are involved in cognitive control and not other behavioral demands. We defined the cognitive control network as the parts of the brain active during a line search task. This

task involves remembering a target line orientation, attending to each probe line orientation, and making a decision about whether each probe is what is being looked for. We then looked at spontaneous neural activity during rest periods to measure how the network's regions are connected. (Cole & Schneider, 2007)

Cognitive controls are defined by Klein et al. (1959) as ego structures or stable organizational dispositions that regulate thought processes. In psychoanalytic terminology, they are characterized as secondary thought processes that produce consistency in a person's perceptual, memory and thinking activities. Cognitive controls are assumed to be relatively "conflict-free" mechanisms and are thought to reflect an individual's customary modes of facing reality.

A cognitive control is thought to unfold in a behavioral sequence that is integrated by an intention or aim, e.g., to judge size in an experiment. Cognitive controls are considered to be the organizing principles that guide the interplay of perceptual, memory and motor processes and the determiners of cognitive responses. A given cognitive control is thought to operate within a limited range of situations that pose similar adaptive requirements. Thus the ability to generalize behaviors particular to a given control are dependent upon the requirements of a given situation. Klein et al. (1959) assume that there are a finite number of cognitive controls and that they are idiosyncratically organized within each individual. It is assumed that cognitive controls interact, serving alternately as an intermediary, catalyst or initiator of behavioral tendencies.

Hypothesis

Visual control influences the postural balance in field tennis players.

Methods and materials

Subjects

The subjects of this study were 20 student-athletes enrolled in the tennis learning courses at the Faculty of Physical Education and Sport at the Babes-Bolyai University, and they were between the ages of 19 and 21 years old. The whole tennis course was 4 months long, therefore allowing us to see if there was an effect over the subjects.

Methods and the Steps of the Research

We used the AMTI Netforce platform for the initial and final test. The test consists of measuring the balance quality with and without a visual aiming control. The software from the force platform laid out, among others, two

measurements for each subject called: length (measured in cm) and area of the center of gravity's projection (measured in cm^2).

The initial and the final measurements correspond with the moment they finished the course, because we wanted to see if there was a better or worse balance control regarding the existence or non-existence of a visual control.

We compared these two measurements for two different situations:

1. The subjects had no visual reference aiming point; they had to look at a blank wall;
2. They had a small target placed on the wall.

The values of the gathered data were analyzed using SPSS 17.0 and the test used was paired sample t-test because we wanted to see if the visual control variable had an influence over the postural balance.

Results

Table 1.

Paired sample statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Lung_I	152218.44	20	113973.166	25485.175
	Lung_F	5960.86	20	5283.156	1181.350
Pair 2	Area_I	15328.81	20	3465.370	774.880
	Area_F	2613.83	20	1564.170	349.759

Table 2.

Paired sample correlations

		N	Correlation	Sig.
Pair 1	Lung_I & Lung_F	20	.497	.026
Pair 2	Area_I & Area_F	20	.332	.153

Table 3.

Paired sample test

		Paired Differences					t	df	Sig. (2-tailed)
					95% Confidence Interval of the Difference				
		Mean	Std. Deviation	Std. Error Mean	Lower	Upper			
Pair 1	Lung_I - Lung_F	146257.582	111439.658	24918.665	94102.216	198412.947	5.869	19	.000
Pair 2	Area_I - Area_F	12714.983	3295.277	736.846	11172.746	14257.220	17.256	19	.000

Discussion of the results

For the trajectory length of the center of gravity, there was a significant difference in the scores for the initial test stage(M_{LI}=152218.44, SD_{LI}=113973.166) and the visual control stage(M_{LF}=5960.86, SD_{LF}=5283.156); tv(19)=-5.869, pv=0.000. These results suggest that the visual control really does have an effect over the balance control of the tennis players. Specifically, our results suggest that when the subject has a visual way to control his posture, the balance control increases.

For the trajectory area of the center of gravity, there was a significant difference in the scores for the initial test stage (M_{AI}=15328.81, SD_{AI}=3465.37) and the visual control stage (M_{AF}=2613.83, SD_{AF}=1564.170); ta(19)=17.256, pa=0.000. These results suggest that the visual control really does have an effect over the balance control of the tennis players. Specifically, our results suggest that when the subject has a visual way to control his posture, the balance control increases.

Conclusions

All in all our study has shown that, regarding field tennis, the balance control is tightly linked with the visual control that a player has. Considering the fact that the values for the length and area of movement of the center of gravity have improved we can determine that field tennis training can increase the balance control with a visual marker.

REFERENCES

Carter CS, Cho RY (2004). *Monitoring impairments in schizophrenia*. In D. Barch (Ed.), *Cognitive and Affective Neuroscience of Psychopathology*, New York, NY. Oxford University Press

Karlene Ball, J.D. Edwards, Lesley A. Ross (2007). The Impact of Speed of Processing Training on Cognitive and Everyday Functions, *Journals of Gerontology: Series B* 2007, Vol. 62B (Special Issue I): 19–31

Cole, M.W., Schneider, W. (2007). *The cognitive control network: Integrated cortical regions with dissociable functions*. NeuroImage, Doi: 10.1016/j.neuroimage.2007.03.071

Gardner, R., Holman, P., Klein, G., Linton, H., Spence, D. (1959) *Cognitive controls. A study of individual consistencies in cognitive behavior,* Psychology Issues, vol. 1(4): 1-12, 114-127