

Robotic neurorehabilitation using Lokomat with Virtual Reality: A retrospective case control study on cognitive function in patients with stroke patients.

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Introduction

Stroke is a clinical condition caused by a focal disruption in the cerebral blood flow due to occlusion (ischemic stroke) or rupture of a blood vessel (hemorrhagic stroke), which has a devastating impact on a patient and his family.

The purpose of this study is to evaluate the effects of robotic neurorehabilitation using Lokomat with virtual reality (VR) on attention process and executive functions in patients with stroke.

Methods

Fifty-six patients with stroke were included in the analysis using an electronic recovery system data (table 1). This retrospective case-control study. The included patients were divided into two groups: LPG carried out a rehabilitation training with Lokomat Pro, connected to a VR screen. Instead, LNG performed the rehabilitation cycle using Lokomat Nanos, without VR (Figure 1). The two groups were matched for age; sex; education; interval from stroke, in a 1:1 ratio. The rehabilitation protocol consisted of 40 training sessions. All the patients underwent a clinical and neuropsychological assessment.

Result

LPG and LNG had a significant enhancement in mood and in the perception of physical well-being. Only in LPG, between baseline and T1, we observed a significant improvement in global cognitive functions, executive functions and attention abilities. Furthermore, LPG presented a significant enhancement of the quality of life, referring to the perception of the mental and physical state (table 2).

Conclusions

Our study supports the idea that the Lokomat is a useful tool in the rehabilitation of the patient with stroke; in particular, the integration of the device with the VR can implement the cognitive and behavioral components of the Stroke patients, encouraging also the physical and mental well-being.



Figure 1 shows the two types of training with Lokomat: the upper part of the figure Lokomat-pro with VR- screen, in which there is an avatar that performs various exercises; in the lower part, the Lokomat-Nanos with screen without VR.

Table 1. Demographics characteristics at baseline for both groups.

	Experimental	Control	All	p-value
Participants	28	28	56	
Age	47.6±12.4	47.6±12.3	47.6±12.3	1.00
Education	3.11±0.6	3.11±0.6	3.11±0.6	1.00
Gender				1.00
Male	18 (64.3%)	18 (64.3%)	36 (64.3%)	
Female	10 (35.7%)	10 (35.7%)	20 (35.7%)	
Interval from stroke				
Mean in months	3 ± 2	3 ± 2	3 ± 2	

Quantitative variables were expressed as means ± standard deviations, categorical variables as frequencies and percentages.

Table 2. Post-hoc analysis of clinical scores between baseline (T0) and follow-up (T1), for both Lokomat-Pro (LPG) and Lokomat-Nanos (LNG) groups.

Clinical assessment	LPG		p-value	LNG		p-value
	T0	T1		T0	T1	
MOCA	22.0 (20.0 - 24.0)	26.0 (24.7 - 28.0)	<0.001	22.5 (20.0 - 24.7)	24.0 (20.0 - 24.2)	0.62
BDI-II	12.5 (10.7 - 14.2)	5.5 (3.0 - 8.0)	<0.001	12.0 (9.25 - 13.2)	11.0 (8.7 - 12.0)	<0.001
TMT-A	148.0 (80.0 - 198.2)	73.0 (45.0 - 94.2)	<0.001	79.5 (57.0 - 168.0)	85.0 (55.7 - 161.0)	0.48
TMT-B	310.5 (186.0 - 335.5)	126.0 (92.0 - 200.0)	<0.001	179.0 (151.2 - 241.5)	180.0 (150.0 - 240.0)	0.81
TMT B-A	196.5 (88.0 - 323.5)	88.0 (38.2 - 170.0)	<0.001	81.0 (64.7 - 147.5)	80.5 (64.7 - 145.0)	0.13
VS	33.1 (27.0 - 40.3)	43.5 (37.8 - 47.5)	<0.001	32.0 (24.7 - 41.2)	33.2 (25.7 - 42.2)	0.02
FAB	10.4 (8.7 - 13.1)	16.6 (16.0 - 17.4)	<0.001	13.7 (12.2 - 16.4)	13.7 (12.0 - 16.0)	0.11
WEIGL	7.6 (5.5 - 9.0)	14.0 (12.0 - 15.0)	<0.001	7.0 (4.6 - 10.8)	6.5 (5.0 - 10.0)	0.12
SF TOT	28.5 (18.0 - 32.0)	38.0 (31.0 - 43.0)	<0.001	23.5 (18.7 - 26.0)	22.0 (15.5 - 25.0)	0.02
SF MH	17.5 (12.7 - 20.0)	25.0 (34.0 - 24.0)	<0.001	13.0 (16.0 - 10.0)	13.0 (16.0 - 10.0)	0.45
SF PH	10.0 (8.7 - 13.0)	26.0 (23.0 - 28.2)	<0.001	15.5 (10.0 - 19.2)	19.5 (14.0 - 22.0)	<0.001

Scores are in median (first-third quartile); significant differences are in bold.

* Frontal Assessment Battery (FAB); Beck Depression Inventory - II (BDI II); Montreal Cognitive Assessment (MoCA); Short Form-12 Health Survey Total (SF-12 TOT); Short Form-12 Health Survey Mental Health (SF-12 MH); Short Form-12 Health Survey Physical (SF-12 Ph); Trail Making Test - Form A (TMT-A); Trail Making Test - Form B (TMT-B); Trail Making Test - Form B-A (TMT B-A); Visual Search (VS); Weigl Test (WEIGL).

References

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